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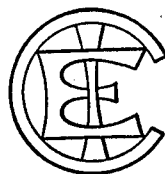
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Installations électriques des bâtiments

Deuxième partie: Principes fondamentaux

Electrical installations of buildings

Part 2: Fundamental principles



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS OF BUILDINGS

Part 2: Fundamental principles

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote this international unification, the IEC expresses the wish that all National Committees having as yet no national rules, when preparing such rules, should use the IEC recommendations as the fundamental basis for these rules in so far as national conditions will permit.
- 4) The desirability is recognized of extending international agreement on these matters through an endeavour to harmonize national standardization rules with these recommendations in so far as national conditions will permit. The National Committees pledge their influence towards that end.

PREFACE

This Recommendation has been prepared by IEC Technical Committee No. 64, Electrical Installations of Buildings.

It forms Part 2 of the Recommendation dealing with Electrical Installations of Buildings. It shall be used in conjunction with Part 1: General and Definitions (IEC Publication 364-1).

Drafts of this Publication were discussed at the meetings held in Paris and in Teheran in 1969. As a result of this latter meeting, a revised draft was submitted to the National Committees for approval under the Six Months' Rule in January 1970.

The following countries voted explicitly in favour of publication of Part 2:

Australia	Japan
Belgium	Netherlands
Brazil	South Africa
Czechoslovakia	Sweden
Finland	Switzerland
France	Turkey
Germany	Union of Soviet Socialist Republics
Israel	United Kingdom
Italy	United States of America

Where countries not yet having national regulations for electrical installations deem it necessary to establish legal requirements for this purpose, it is recommended that such requirements be limited to fundamental principles which are not subject to frequent modification on account of technical development. The contents of Part 2 may be used as a basis for such legislation.

ELECTRICAL INSTALLATIONS OF BUILDINGS

Part 2: Fundamental principles

SECTION ONE — PROTECTION FOR SAFETY

1. General

X The requirements stated in this Section are intended to ensure the safety of persons, livestock and property against dangers and damage which may arise in the reasonable use of electrical installations.

Note. — In electrical installations, two major types of risk exist:

- shock currents;
- excessive temperatures likely to cause burns, fires and other injurious effects.

2. Protection against direct contact

X Persons and livestock shall be protected against dangers that may arise from contact with live parts of the installation. X

This protection can be achieved by one of the following methods:

- preventing a current from passing through the body of any person or any livestock;
- limiting the current which can pass through a body to a value lower than the shock current.

3. Protection against indirect contact

Persons and livestock shall be protected against dangers that may arise from contact with exposed conductive parts.

This protection can be achieved by one of the following methods:

- preventing a fault current from passing through the body of any person or any livestock;
- limiting the fault current which can pass through a body to a value lower than the shock current;
- automatic disconnection of the supply on the occurrence of a fault likely to cause a current to flow through a body in contact with exposed conductive parts, where the value of that current is equal to or greater than the shock current.

4. Protection against thermal effects in normal service

The electrical installation shall be so arranged that there is no risk of ignition of flammable materials due to high temperature or electric arc. Also, during normal operation of the electrical equipment, there shall be no risk of persons or livestock suffering burns.

5. Protection against overcurrent

Persons or livestock shall be protected against injury and property shall be protected against damage due to excessive temperatures or electromechanical stresses caused by any overcurrents likely to arise in live conductors.

This protection can be achieved by one of the following methods:

- automatic disconnection on the occurrence of an overcurrent before this overcurrent attains a dangerous value taking into account its duration;
- limiting the maximum overcurrent to a safe value and duration.

6. Protection against fault currents

Conductors, other than live conductors, and any other parts intended to carry a fault current shall be capable of carrying that current without assuming excessive temperature.

Notes 1. — Particular attention should be given to earth fault currents.

2. — For live conductors, compliance with Clause 5 assures their protection against any fault currents, including overcurrents caused by faults.

7. Protection against overvoltage

7.1 Persons or livestock shall be protected against injury and property shall be protected against any harmful effects of a fault between live parts of circuits supplied at different voltages.

7.2 Persons or livestock shall be protected against injury and property shall be protected against damage from any excessive voltages likely to arise due to other causes (e.g. atmospheric phenomena or switching voltages).

SECTION TWO — DESIGN

8. General

For the design of the electrical installation, the following factors shall be taken into account to ensure:

- the protection of persons, livestock and property in accordance with Section One;
- the proper functioning of the electrical installation for the use intended.

The information required as a basis for design is listed in Clauses 9, 10, 11 and 12. The requirements with which the design should comply are stated in Clauses 13 to 19.

9. Characteristics of the available supply or supplies

9.1 Nature of current: a.c. and/or d.c.

9.2 Nature and number of conductors:

- For a.c.: phase conductor(s);
neutral conductor;
protective conductor.
- For d.c.: conductors equivalent to those listed above.

9.3 Values and tolerances:

- voltage and voltage tolerances;
- frequency and frequency tolerances;
- maximum current allowable;
- prospective short-circuit current.

9.4 Protective measures inherent in the supply, e.g. earthed (grounded) neutral or mid-wire.

9.5 Particular requirements of the supply undertaking.

10. Nature of demand

The number and type of the circuits required for lighting, heating, power, control, signalling, telecommunication, etc. are to be determined by:

- location of points of power demand;
- loads to be expected on the various circuits;
- daily and yearly variation of demand;
- any special conditions;
- requirements for control, signalling, telecommunication, etc.

11. Emergency supply or supplies

- Source of supply (nature, characteristics).
- Circuits to be supplied by the emergency source.

12. Environmental conditions

Under consideration.

13. Cross-section of conductors

The cross-section of conductors shall be determined according to:

- a) their admissible maximum temperature;
- b) the admissible voltage drop;
- c) the electromechanical stresses likely to occur due to short-circuits;
- b) other mechanical stresses to which the conductors may be exposed;
- e) the maximum impedance with respect to the functioning of the short-circuit protection.

Note. — The above-listed items concern primarily the safety of electrical installations. Cross-sectional areas greater than those required for safety may be desirable for economic operation.

14. Type of wiring and methods of installation

The choice of the type of wiring and the methods of installation depend on:

- the nature of the locations;
- the nature of the walls or other parts of the building supporting the wiring;
- accessibility of wiring to persons and livestock;
- voltage;
- the electromechanical stresses likely to occur due to short-circuits;
- other stresses to which the wiring may be exposed during the erection of the electrical installation or in service.

15. Protective equipment

The characteristics of protective equipment shall be determined with respect to their function which may be, e.g., protection against the effects of:

- overcurrent (overload, short-circuit);
- earth-fault current;
- overvoltage;
- undervoltage and no-voltage.

The protective devices shall operate at values of current, voltage and time which are suitably related to the characteristics of the circuits and to the possibilities of danger.

16. Emergency control

Where, in case of danger, there is necessity for immediate interruption of supply, an interrupting device shall be installed in such a way that it can be easily recognized and effectively and rapidly operated.

17. Disconnecting devices

Disconnecting devices shall be provided so as to permit disconnection of the electrical installation, circuits or individual items of apparatus as required for maintenance, testing, fault detection or repair.

18. Prevention of mutual influence between electrical and non-electrical installations

The electrical installation shall be arranged in such a way that no mutual detrimental influence will occur between the electrical installation and non-electrical installations of the building.

19. Accessibility of electrical equipment

The electrical equipment shall be arranged so as to afford as may be necessary:

- sufficient space for the initial installation and later replacement of individual items of electrical equipment;
- accessibility for operation, testing, inspection, maintenance, and repair.

SECTION THREE — SELECTION OF ELECTRICAL EQUIPMENT

20. General

Every item of electrical equipment used in electrical installations shall comply with such IEC Recommendations as are appropriate.

21. Characteristics

Every item of electrical equipment selected shall have suitable characteristics appropriate to the values and conditions on which the design of the electrical installation (see Section Two) is based and shall, in particular, fulfil the following requirements.

21.1 Voltage

Electrical equipment shall be suitable with respect to the maximum steady voltage (r.m.s. value for a.c.) likely to be applied, as well as overvoltages likely to occur.

Note. — For certain equipment, it may be necessary to take account of the lowest voltage likely to occur.

21.2 Current

All electrical equipment shall be selected with respect to the maximum steady current (r.m.s. value for a.c.) which it has to carry in normal service, and with respect to the current likely to be carried in abnormal conditions and the period (e.g. operating time of protective devices if any) during which it may be expected to flow.

21.3 Frequency

If frequency has an influence on the characteristics of electrical equipment, the rated frequency of the equipment shall correspond to the frequency likely to occur in the circuit.

21.4 Power

All electrical equipment, to be selected on the basis of its power characteristics, shall be suitable for the duty demanded of the equipment, taking into account the load factor and the normal service conditions.

22. Conditions of installation

All electrical equipment shall be selected so as to withstand safely the stresses and the environmental conditions (see Section Two, Clause 12) characteristic of its location and to which it may be exposed. If, however, an item of equipment does not have by design the properties corresponding to its location, it may be used on condition that adequate additional protection is provided as part of the completed electrical installation.

23. Prevention of harmful effects

All electrical equipment shall be selected so that it will not cause harmful effects on other equipment or impair the supply during normal service including switching operations. In this context, the factors which may have an influence include, e.g.:

- power factor;
- inrush current;
- asymmetrical load;
- harmonics.

SECTION FOUR - ERECTION AND INITIAL TESTING OF ELECTRICAL INSTALLATIONS

24. Erection

- 24.1 For the erection of the electrical installation, good workmanship by suitably qualified personnel and the use of proper materials shall be provided for.
- 24.2 The characteristics of the electrical equipment, as determined in accordance with Section Three, shall not be impaired in the process of erection.
- 24.3 Protective conductors and neutral conductors shall be identifiable at least at their terminations by colouring or other means. These conductors in flexible cords or flexible cables shall be identifiable by colouring or other means throughout their length.
- 24.4 Connections between conductors and between conductors and other electrical equipment shall be made in such a way that safe and reliable contact is ensured.
- 24.5 All electrical equipment shall be installed in such a manner that the designed cooling conditions are not impaired.
- 24.6 All electrical equipment likely to cause high temperatures or electric arcs shall be placed or guarded so as to eliminate the risk of ignition of flammable materials. Where the temperature of any exposed parts of electrical equipment is likely to cause injury to persons, those parts shall be so located or guarded as to prevent accidental contact therewith.

25. Initial testing

Electrical installations shall be tested and inspected before being placed in service and after any important modification to verify proper execution of the work in accordance with this Recommendation.
